Air

Land

Sea

Space

Cyberspace

Innovation. In all domains.

Expediting Technology Innovation in Industry
Putting Ideas into Action

Jill Pate
Raytheon Company
Network Centric System
Jill_A_Pate@raytheon.com

April 13, 2010

# *Putting Ideas into Action*

Key Messages

- The Defense Industry was built on a legacy of *Putting Ideas into Action*

- We survey, vet and act on the best ideas from a wide-variety of sources:

  - *Government guided*

  - *Small businesses*

  - *Universities*

  - *Nonprofits/Think Tanks*

  - *Company organic*

- We invest heavily in research and development to expedite innovation to the warfighter

- Our processes are our strength by ensuring the integrity of mission assurance while *Putting* <u>a large and highly diverse set</u> of *Ideas into Action*

Putting Ideas into Action – An Historical Perspective

THE ILLUSTRATED TIMELINE OF
Inventions
A CRASH COURSE IN WORDS & PICTURES
CRAIG SANDLER
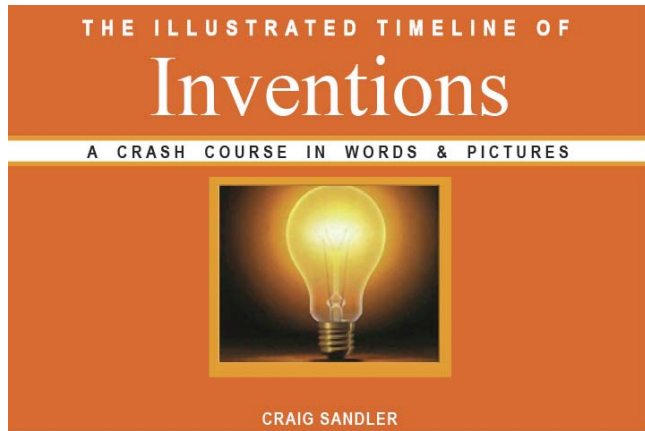
The Illustrated Timeline of Inventions
By Craig Sandler

|	1 Million BC The Spear	34,000 BC The 1st House
Idea	Homo erectus lash stones knives to poles.	Homo sapiens create a shelter using mammoth bones and wood, covering the frame in animal hides: the first house.
Impact	The spear transforms the hunt and improves nutrition. Recent record suggests improved defensive capability, discouraged attacks and reduced tribe violence.	Clustered houses lead to first villages, foster cooperation, encourage social evolution.

Putting Ideas into Action has been around as long as Mankind

Putting Ideas into Action – A Defense Perspective
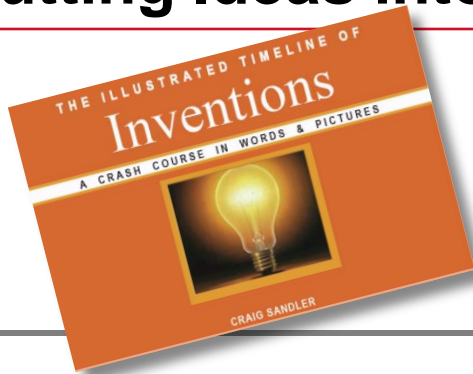
War spurs invention – WWI is noted for the Atomic Bomb. However, the technology war was waged on many fronts as the world's leading engineers and industrialists devoted themselves to the cause.

Aircraft

Jet Engines

Ballistic Missiles

Long Range Bombers

Communications

Microwave

Radar

Information Science

Circuit Boards

Digital Computer

Textiles and Materials

Plastics

Synthetic fabrics

Weapons

Atomic Bomb

Submarines

Putting Ideas into Action **accelerates during times of great challenge**

Putting Ideas into Action – A Raytheon Perspective

Spenser with Magnetron

British scientists developed short-wave, or microwave, radar to detect enemy aircraft; however, unable to mass produce the magnetron tube, which was the heart of the radar's function.

Raytheon engineer Percy Spencer, a man with only a grade school education, yet a remarkable sense of curiosity, simplified the manufacturing process. Raytheon became the major supplier during the war providing the most important military advantage for the Allied Forces.

Unlike Britain, the United States was in peril of defeat at sea. Raytheon's Fritz Gross, one of the company's most talented young engineers, developed microwave SG radar, a shipboard radar that was far superior to radars carried on planes because German submarines could not tune in on their frequencies as they could with aircraft radar. By the end of the war, every U.S. PT boat was equipped with Raytheon radar, protecting the Allied convoys by searching out and destroying U-boats.

Raytheon
Radar Technology Leadership

Raytheon Advanced Combat Radar (RACR)

Airborne Stand-Off Radar (ASTOR)

AN/ALR-69A(V) Radar Warning Receiver

F-15 Radar and Electronic Warfare Engineering Services

Advanced Synthetic Aperture Radar System (ASARS) 2

We have produced more than a dozen 'unique' RADAR products leading to 100,000's of fielded radars

Defense Industry continues with the legacy of *Putting Ideas into Action*

Raytheon Today

- A *technology and innovation leader* specializing in defense, homeland security and other government markets throughout the world
- 2009 net sales: $25 billion
- 75,000 employees worldwide
- Headquarters: Waltham, Massachusetts

Core Market: Sensing
Technologies that acquire data and create accurate, reliable information for effective battlespace decisions.

Core Market: Effects
Technologies that achieve specific military actions or outcomes.

Core Market: C3I
Command, control, communication and information: Integrated real-time systems that optimize operational planning and execution.

Core Market: Mission Support
Integrated training solutions, range operations, engineering services and counter-terrorism

Putting Ideas into Action has transformed
Raytheon into a global leader in technology and innovation

Raytheon

Innovation at Raytheon

William H. Swanson
Chairman and CEO
Raytheon Company

William H. Swanson on Technology and Innovation

"Raytheon is a technology company. We believe that developing the best solutions for our customers is all about fostering an open culture that supports rich dialog to generate the best ideas. In other words, it comes down to inclusion: creating a welcoming environment, drawing on the largest pool of the best talent, and encouraging diversity of thought and opinion with customer success in mind."

Raytheon
2008 Annual Report

It's all about innovation.

Air. Land. Sea. Space. Cyberspace. Wherever the need, Raytheon is there with innovations that protect, defend and secure. Our domain knowledge and technological leadership continue to fuel growth in core markets and adjacent markets, domestically and internationally. Our record of NoDoubt® performance on behalf of customers in 80 countries grew stronger than ever in 2008, generating excellent results for our shareholders. Yet we have much more to do. Our commitment is absolute. Our opportunities are endless.
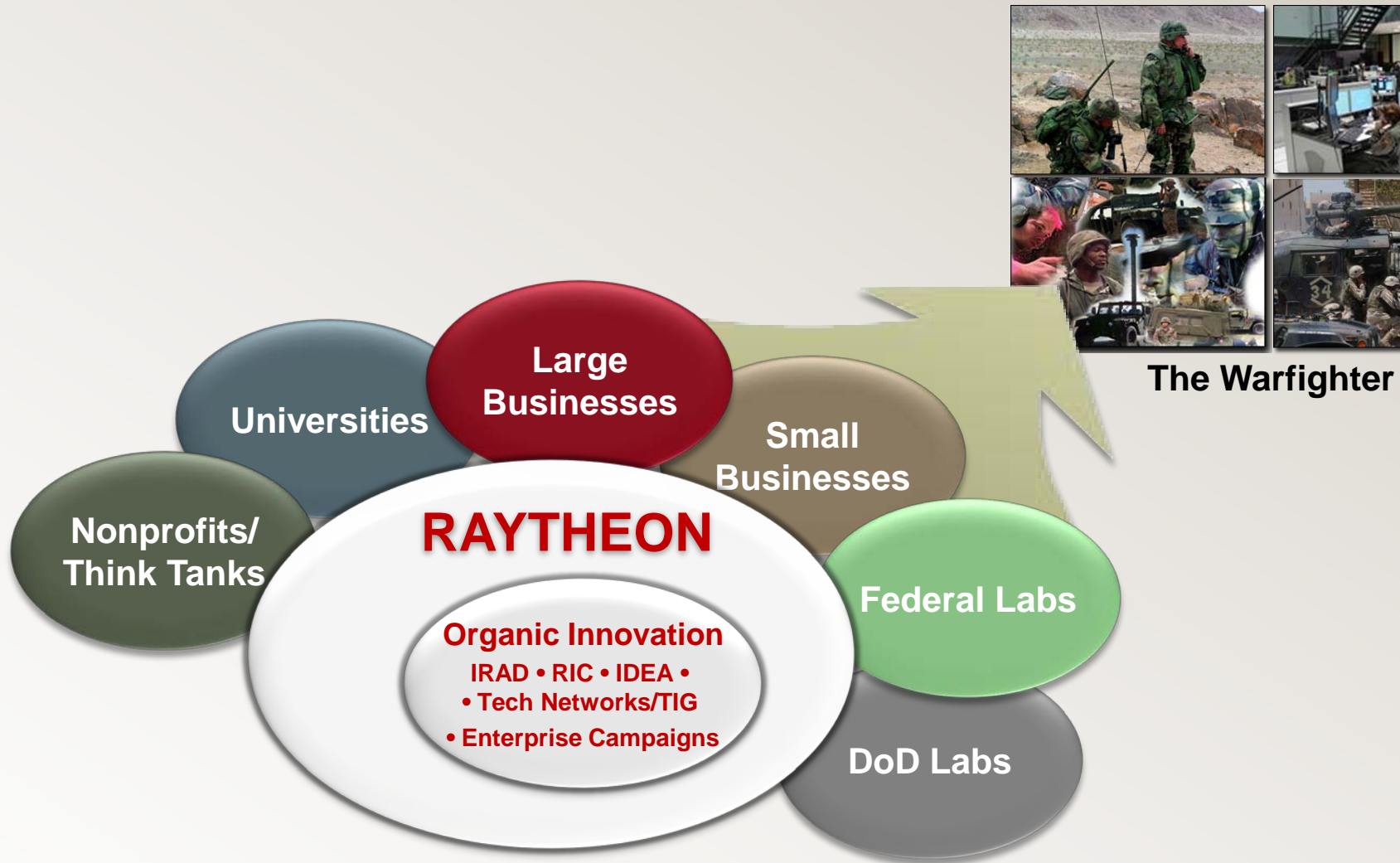
INNOV ATION

Technology Today

HIGHLIGHTING RAYTHEON'S TECHNOLOGY

Raytheon's Culture of Innovation
Providing Leading-Edge Customer Solutions

Raytheon
Customer Success Is Our Mission

**As defense industry leadership, we must be cognizant…
…no formula or calculation ever inspired a great idea**

Putting Ideas into Action
Defense Industry Collaborates to Transition the Best Ideas
Raytheon Example

Universities

Large Businesses

Small Businesses

Nonprofits/ Think Tanks

RAYTHEON

Organic Innovation
IRAD • RIC • IDEA •
• Tech Networks/TIG
• Enterprise Campaigns

Federal Labs

DoD Labs

The Warfighter

The challenges faced by today's warfighter require collective innovation

Putting Ideas into Action
2010 Raytheon Innovation Challenge (RIC)

Raytheon

Innovating the Future

RIC Challenge Areas

1. Biometrics capture, image conversion, and matching
2. Surviving cyber attacks
3. GPS free timing, navigation, and guidance
4. Social and culture ISR
5. Explosive and chem/bio deterrence in urban environments

- **223 Whitepapers received**
- **~50 selected for workshop**
- **Workshop April 12-16 in Orlando**

	1	2	3	4	5	
Submissions	52	31	59	46	35	= 223

 # Submitted (y-axis: 0–60)

Challenge #
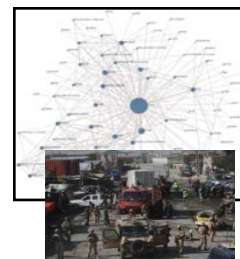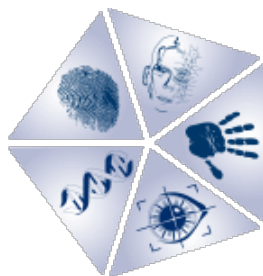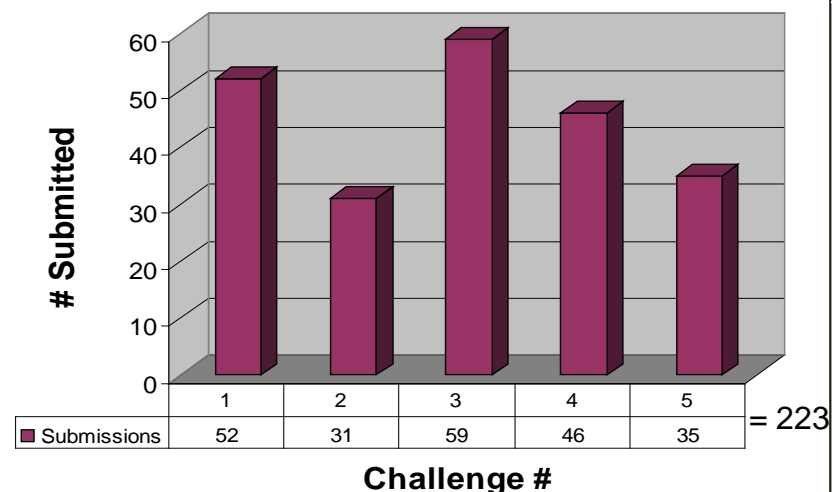
Innovation program soliciting ideas from across Raytheon in response to key customer capability needs

Putting Ideas into Action
Raytheon IDEA Program

Raytheon

Purpose:

- Incubator of new ideas
- Projects are $10k - $50k
- Feeds IRAD/CRAD pipeline

Dr Carl Cotner (IIS)
2008 Innovator of the Year Award

IDEA Program

2007:
- **59 ideas submitted**
- **27 projects funded**
- **15 patent disclosures**

2008:
- **62 ideas submitted**
- **22 projects funded**
- **20 patent disclosures in process**

2009:
- **>90 white papers submitted**
- **20 projected funded**
- **> 20 patent disclosures**

Generating new intellectual property and customer R&D (CRAD)

Putting Ideas into Action
Raytheon Idea Formation Tool

Validate or improve a good idea through collaboration

Putting Ideas into Action
Raytheon Technology Networks

Raytheon

- The Technology Networks provide our **technologists** with a unique opportunity to **reach out and interact** with others **across the entire company**.

- **5 Technology Networks**, comprising over **7,000 Raytheon engineers**:
  - *Information Systems & Computing*
  - *Multi-function Electro Optics Systems*
  - *Multi-function Radio Frequency Systems*
  - *Mechanical, Materials, & Structures*
  - *Mission Systems Integration*

- Symposia, Workshops, Special Projects, Regular telecons
- More than 100 Technology Interest Groups (TIGs) sponsored by the TNs
- Self-register on oneRTN ► eRoom, Lotus email group
- 20+ additional TIGs in various stages of formation
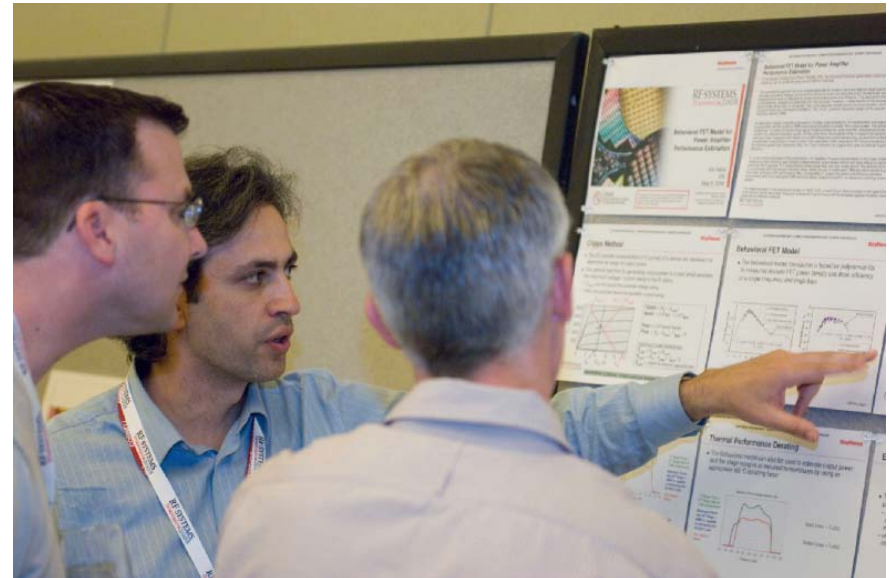
A unique forum for mentoring, collaboration and the exchange of ideas

Putting Ideas into Action
Defense Industry Invests to Expedite Technology
Raytheon Example

Company ('09 Annual Report)	R&D Investment	Revenue	%
CISCO	$5.2B	$36.1B	14%
Intel	$5.7B	$35.1B	16%
IBM	$5.8B	$95.8B	6%
GE	$3.3B	$156.8B	2%
3M	$5.6B	$23.1B	24%
Raytheon [1]	$6.8B	$24.9B	27%

Note (1): "R&D" in this context refers to all research and new product development activities.

Putting Ideas into Action first occurs when intellectualism is matched with capitalism

Putting Ideas into Action
Defense Industry Manages the Process
Raytheon Example

Today's Challenges

Technology

- Understand current and emerging customer mission needs

- Identify technology gaps
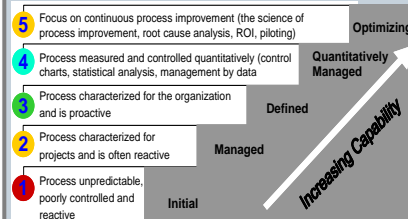
- Focus technology road maps to fill these gaps

Talent

- Engineers are focused and well trained through certification programs

- Certified Architects applying best-in-class practices to major programs

- Program Chief Engineers drive Mission Assurance and KPPs

- Technical Directors drive strategy to create and identify enabling technologies for growth

Process

- Process enables speed with quality Integrated Product Development Systems (IPDS)

- CMMI

5	Focus on continuous process improvement (the science of process improvement, root cause analysis, ROI, piloting)	**Optimizing**
4	Process measured and controlled quantitatively (control charts, statistical analysis, management by data)	**Quantitatively Managed**
3	Process characterized for the organization and is proactive	**Defined**
2	Process characterized for projects and is often reactive	**Managed**
1	Process unpredictable, poorly controlled and reactive	**Initial**

Increasing Capability

CMMI® Levels

- Mission Assurance/Lessons Learned…

- Productivity enhancements through automation

Performance

- On-time deliveries

- Key Performance Parameters

- Cost as an Independent Variable (CAIV)
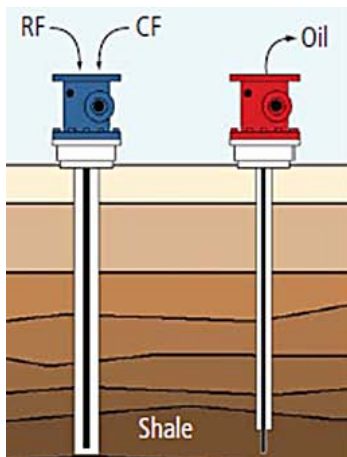
- SPI/CPI

- Business Operating Reviews

Great ideas start with customer needs and are *Put into Action* through process excellence

# Putting Ideas into Action Raytheon Case Study

Radio Frequency / Critical Fluid Oil Extraction Technology

Radio frequency (RF) energy combined with critical fluid (CF) technology may help efficiently and safely extract oil from shale. It is projected that the same process may also be used to extract oil from tar sands and to revive spent wells.

Benefits

- Uses half to one-third the energy of competing methods
- Faster overall process than competing methods (months vs. years)
- Less environmental impact than competing oil-shale extraction methods
- Potential to reduce greenhouse gases
- No mining involved in process
- Potential for heat and carbon-dioxide recovery and reuse
- Generates less thermal pollution than competing methods
- Extremely efficient; very high recovery yield
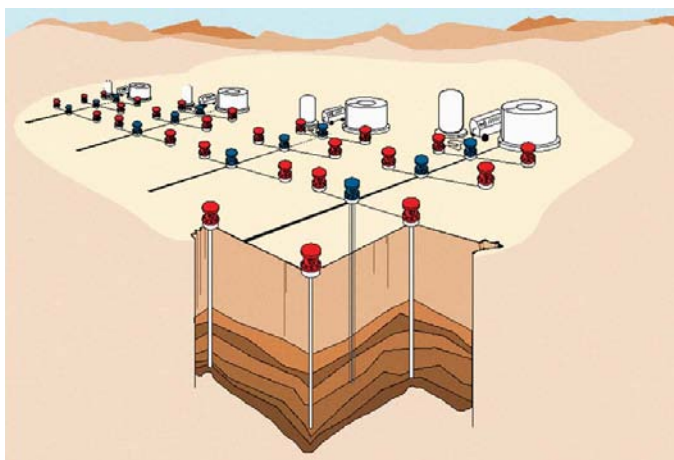
Applying WWII radio technology to solve our Nation's energy problems

Putting Ideas into Action

Summary

– The Defense Industry was built on a legacy of *Putting Ideas into Action.*

– We survey, vet and act on the best ideas from a wide-variety of sources to focus our collective scarce resources on the most viability solutions.

– We invest heavily in research and development to prove concept viability, reduce risk and expedite innovation to the warfighter.

– We have sound processes which provide for speed and agility while ensuring mission success.

– We stand ready to collaborate across the product development cycle with our military customer, academia, labs and industry to refine the process of *Putting Ideas into Action*.